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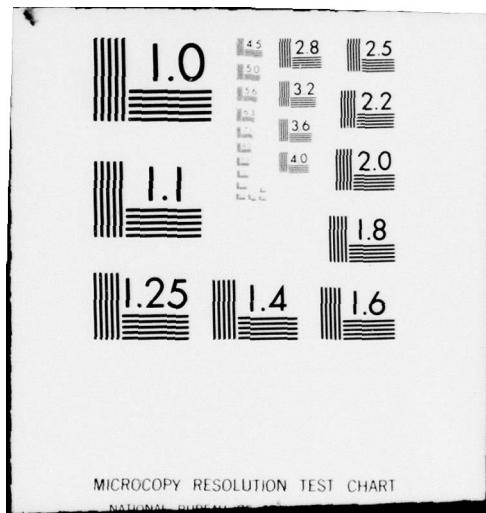
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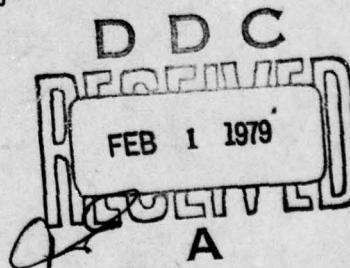
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Wolfgang Pfister, 1906-1976: An Appreciation of His Life and Work

KURT TOMAN

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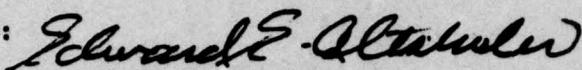


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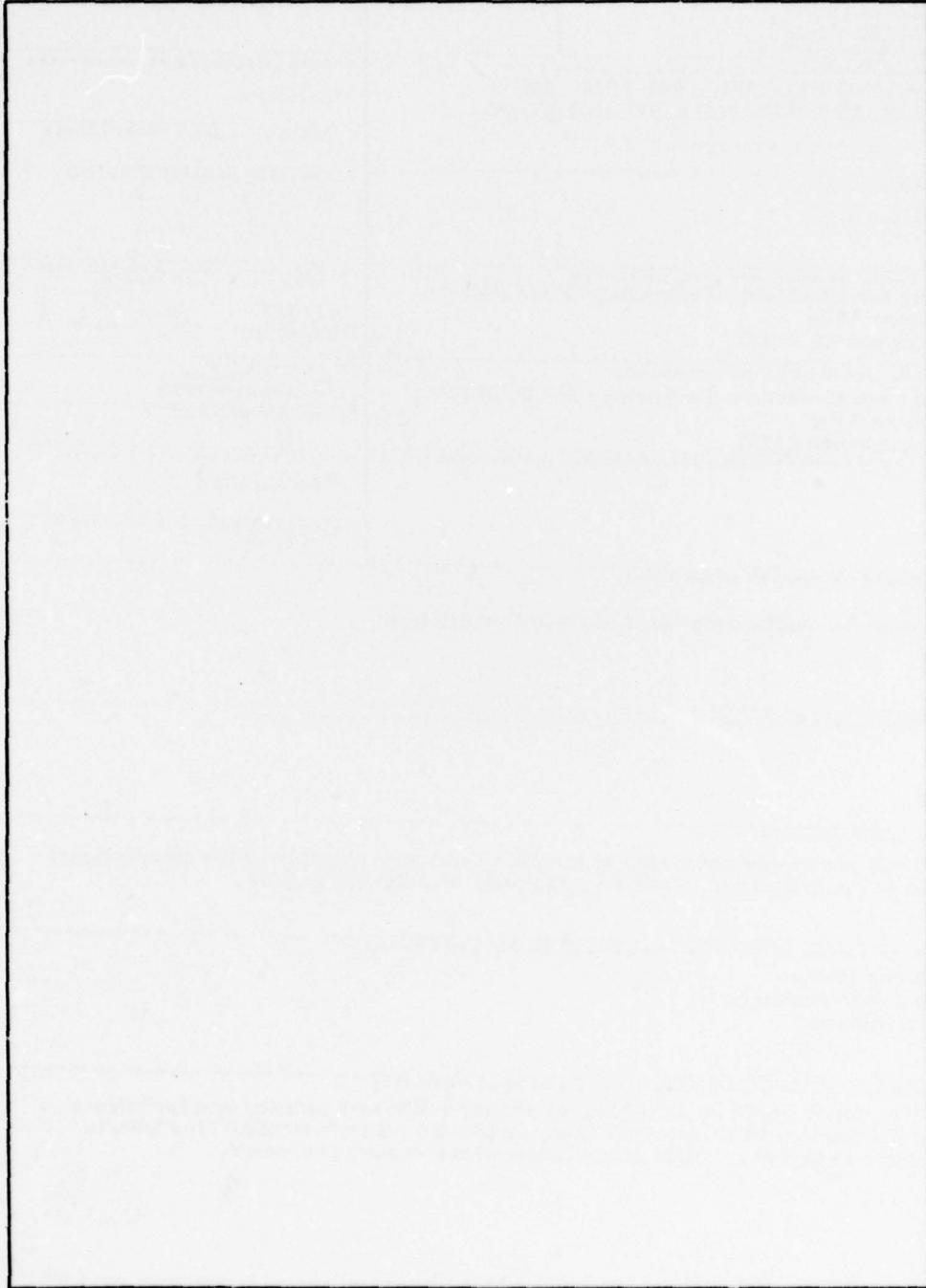
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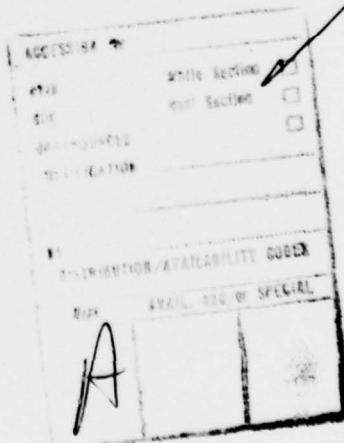


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Preface

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Dr. Wolfgang Pfister

Wolfgang Pfister, 1906-1976: An Appreciation of His Life and Work

I. INTRODUCTION

With the death of Wolfgang Pfister on 4 September 1976, the field of ionospheric physics lost a man whose name and contributions have become indelibly engraved in its annals. Wolfgang Pfister was born in Munich, Germany, 16 August 1906. His father was president of the judicial court for Upper Bavaria, and was also active in election reforms in the Weimar Republic. His mother was an activist for women's rights.

Pfister studied at the Humanistische Gymnasium in Munich. In 1929 he received the Diplom Ingenieur from the Technischen Hochschule (T.H.) Munich, and joined Siemens in Berlin, where he worked on the development of "talking pictures." He resumed his studies at the same school and in 1934 received his PhD under Dieckmann for his thesis on the investigation of the non-quasistationary current distribution in conducting wire systems. Results were applied to the construction of an effective HF antenna for large dirigibles such as the Hindenburg. Thereafter, Pfister joined the Deutsche Versuchsanstalt fuer Luftfahrt (DVL), an Aviation Research Laboratory in Berlin where he soon became Division Chief, a post he held until 1945. In the two years following World War II, he struggled for physical and professional survival. In 1946 he married Josephine Mueller in Regensburg, Germany.

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In 1947 he accepted an invitation that took him to Wright-Patterson AFB in Dayton, Ohio. His stay there was brief. In October 1948 he went to the Air Force Cambridge Research Center (Cambridge Field Station), and remained with that organization until his retirement in 1974. For Pfister, retirement did not mean cessation of scientific work. He continued his studies and analyses of radar signals and their Doppler- and angle-of-arrival signatures resulting from irregularities in the auroral ionosphere. In 1975 he attended the General Assembly of the International Union of Radio Science in Lima, Peru, where he presented what was to be his last paper to Commission G. It dealt with the "Spectral Analysis of F Region Drift Measurements in Goose Bay, Labrador." He became critically ill in July 1976 and died on 4 September 1976.

2. PROFESSIONAL LIFE

Pfister's professional career began in 1932 and lasted more than 40 years, resulting in a large number of publications. In 1935, at the age of 29, he disclosed an invention on the subject of increasing the directivity of a vertically polarized antenna. This was achieved by mechanically separating a vertical antenna element into sections, while electrically connecting the inner conductor of one with the outer conductor of the other section, and vice versa.

A patent search was initiated on 6 May 1935. It revealed that patents for related inventions had been awarded in England (1920) and Germany (1929), but the identical antenna concept had already been invented and patented, as of 8 March 1934, by a Frenchman, Monsieur Andre Morizot. Pfister did not receive a patent for his invention. Curiously, this antenna design, which increased an antenna's directivity, was re-invented in 1963 by Ken Bowles for use in the 50 MHz antenna array of the incoherent-scatter facility at Jicamarca, Peru.

Pfister's entire professional career can be subdivided into four phases: (1) Antennas, (2) Tropospheric Radio Wave Propagation, (3) Ionospheric Radio Wave Propagation, and (4) Satellite and Rocket Measurements of the Ionosphere.

Phase 1 on antennas was ushered in through his thesis and subsequent invention. In this phase of work he dealt with the design of antennas for aircrafts and boats at VHF and UHF. This phase extended from 1932 to 1935 and involved primarily studies of directional antennas and determination of antenna patterns.

Phase 2 on tropospheric radio wave propagation began in 1936. It involved studies of VHF propagation along a curved earth, and led to publications in the IRE Proceedings in 1937 and 1938.

During the period from 1936 to 1945, Wolfgang's work involved radio wave propagation in the troposphere over a layered, conducting ground; direction finding; jamming of frequency-modulation navigation receivers; determining the limits in ground-wave navigation; etc. He also developed and designed a precision navigation system for aircraft. Four Erika stations were installed (Cherbourg, Boulogne, Munich, Vienna) covering northern Europe, each consisting of five spaced transmitter houses and elaborate antenna towers.

World War II ended and a bleak period followed until, in 1949, a paper appeared in the Journal of Geophysical Research entitled "Effect of the D Ionospheric Layer on VLF." This was the serious beginning of Phase 3, ionospheric radio wave propagation, which lasted until 1976, the year of his death.

From 1949 to 1959, many scientific contributions resulted from Pfister's innovation of using an airborne ionospheric laboratory for obtaining measurements of ionospheric characteristics and propagation effects. Pfister was instrumental in the development of a D-region chemistry computer code used for the study of solar ionization and nuclear effects. He participated in the International Geophysical Year (1957/58) and contributed to professional groups such as the U.S. National Committee of the International Union of Radio Science, serving for three years as Secretary of the Commission "On the Ionosphere" (now Ionospheric Radio). He was a contributing member of Working Group II of the Committee for Space Research (COSPAR) and of the Inter-Union Commission on Solar Terrestrial Physics. He also provided much guidance and critical appraisal in various research fields to a new generation of ionospheric physicists at Pennsylvania State University.

In Pfister's phase 4, a subset of phase 3, satellites and rockets were used to measure the structure and characteristics of ionospheric irregularities, ionospheric electron density profiles, and electric fields. Phase 4 seems to have started in 1956 with a paper on the study of fine structure and irregularities in the ionosphere by means of rockets and satellites, prior to the launch of the U.S.S.R. Sputnik on 4 October 1957. Phase 4 seems to have ended in 1970. It resulted in publications on the measurement of charge density and temperature in the aurora; the measurement of electric fields by means of retarding potential analyzers; pulse delay measurements from rockets; satellite measurements of the spatial-temporal variations of electron density; the measurement of ionospheric irregularities with satellite probes; and rocket-borne ionospheric measurements using electron and ion probes.

In 1968, Pfister began publishing a comprehensive series of AFCRL reports on the general subject of pulse sounding with closely spaced receivers measuring atmospheric motion and fine structure in the ionosphere. During the 1968 to

1975 period he also published a study on the wavelike nature of inhomogeneities in the E region, and made a critical survey of probe measurements of electron and ion temperatures. In these late years of his career, Pfister's professional interest centered on characteristics of radar returns from ionospheric irregularities as observed by means of ground-based or airborne radars. In these studies, he tried to find ways of minimizing the expected effects of auroral or ground clutter on high-frequency radar performance by searching for beam-forming and data-processing techniques that would allow the neutralization of these effects. He envisioned that localized "hot-spots" in clutter caused by auroral irregularities could be nullified.

Some of Pfister's earlier work was referenced in books of Hollmann, Vilbig, and Zenneck in Germany; and references to his work appeared in books by Budden, Ratcliffe, and Kelso and in Bowhill's reviews of Radio Science.

3. PERSONAL PROFILE

Pfister was the oldest of three brothers. His two younger brothers live in Germany and one of them, Raimund, is a well-known linguist. Pfister is survived by his wife, Josephine, who resides in Lexington, Massachusetts, where the Pfisters have lived since 1951, and two sons, Andreas and Leonhard. Andreas, the younger son, lives in the Boston area. Leonhard received his PhD degree in meteorology from the University of Washington in 1977 for his work, "A Theoretical Study of Baratropic Instability With Possible Application to the Stratosphere."

In his bachelor years in Germany, Pfister enjoyed sailing, hiking, swimming, skiing, glider flying, and rock climbing; he also made pencil sketches and played piano as an accompanist in a music group. Later, as a devoted family man, he imparted his enthusiasm for outdoor activities and music to his family. After his retirement he became involved in local and national politics, and he campaigned for Udall's presidency in 1976. He reached out for improvements in protecting the environment and supported the Environmental Defense Fund. He was also interested in subjects dealing with the poverty of nations and the poverty of power. Pfister believed that man's emotional and social growth lagged behind the growth in technology. He felt that reducing the technological growth rate would reduce crime rates, racial disturbances, drug abuse, mental illnesses, divorce rates, etc., thereby improving the quality of life. Accelerating man's social and emotional growth, to cope effectively with the social consequences of a fast growing technology, did not seem feasible to him.

Wolfgang Pfister pursued his personal beliefs and convictions quietly and unobtrusively, but with wisdom and thoroughness. One had to probe to gain access to Pfister's insights, as it was his nature not to overwhelm others with the perceptions he had developed privately. He had a penetrating intellect and was always ready to explain and defend his scientific insights or hypotheses rather than rest his case on the silent power of his reputation. He usually revealed new ideas in a final rather than tentative state, and it was difficult for his colleagues to find faults in his reasoning. He was uncompromisingly dedicated to the truth. Of his own work, he stated with clarity, and without hesitation, what had and what had not been accomplished in a particular scientific study. Pfister was a "straight arrow" man. For relaxation, he read the poetry and prose of Karl Heinz Waggerl.

4. CONCLUDING REMARKS

Pfister's concern for ecology and his need to participate in shaping and analyzing new ideas for improving the human condition led him to take issue with book reviews and, in the process, express his own visions. One published review, dated 1 July 1976, ended as follows:

"What we need now is a reexamination of old fundamental beliefs, a breaking down of ideological barriers between different disciplines of human endeavor, in short, ecological reasoning in the broadest sense of the word, so that in the end the general citizen can comprehend again what is going on around him."

5. WOLFGANG PFISTER'S PUBLICATIONS

1932

Verfahren zur Erregung eines Luftfahrzeuges in $\lambda/2$, DVG (Publication data at present unknown).

1933

Eigenerregung eines Schiffskoerpers, DVG.

1935

Untersuchungen ueber die nicht-quasistationaere Stromverteilung in linearen Leitersystemen, Leipzig, Barth, 1935. Inaugural-dissertation, under Dieckmann, Muenchen. Republished in Annalen der Physik, 1935, 22: 31-52.

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